Serial No.; 10/010,721 Examiner: A. Psilos

Title: RELIEF DIFFRACTION GRATING BODY, AND OPTICAL PICK-UP AND OPTICAL INFORMATION APPARATUS

USING THE SAME

## Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

## Listing of Claims:

- 1. (canceled)
- 2. (canceled)
- 3. (canceled)
- 4. (canceled)
- 5. (canceled)
- 6. (canceled)
- 7. (canceled)
- 8. (canceled)
- 9. (canceled)
- 10. (canceled)
- 11. (canceled)
- 12. (canceled)
- 13. (canceled)
- 14. (canceled)
- 15. (canceled)
- 16. (currently amended) An optical pick-up, comprising:

a diffraction grating body, comprising a base material, and a relief diffraction grating formed on the base material, wherein

the diffraction grating body is formed of a single base material, and the refractive index nl of the single base material is 1.9 or more,

the diffraction grating is formed of a concave portion and a convex portion having rectangular shaped cross sections, and the level difference h between the concave portion and the convex portion satisfies the following relationship:

Serial No.; 10/010.721

Examiner: A. Psitos

wavelength λ1;

TIME: RELIEF DIFFRACTION GRATING BODY, AND OPTICAL PICK-UP AND OPTICAL INFORMATION APPARATUS USING THE SAME

 $b=\lambda 1/(n1-1)$ 

and the difference in an optical path between the concave portion and the convex portion is set to correspond to one wavelength with respect to the wavelength  $\lambda 1$ , and

a material of the <u>single</u> base material is at least one material selected from the group consisting of Ta<sub>2</sub>O<sub>5</sub>, <u>TiO<sub>2</sub></u>, ZrO<sub>2</sub>, Nb<sub>2</sub>O<sub>3</sub>, ZnS, LiNbO<sub>3</sub> and LiTaO<sub>3</sub>;

a first semiconductor laser light source for emitting a light beam with

a second semiconductor laser light source for emitting a light beam with wavelength  $\lambda 2$ ;

an optical system having an optical disk, the optical system for receiving the light beam with wavelength  $\lambda 1$  and the light beam with wavelength  $\lambda 2$  and converging the light beam onto a microspot on the optical disk;

a diffraction means provided as a separate element from the diffraction grating body, the diffraction means being arranged for diffracting a light beam reflected from the optical disk;

and

a photodetector having a photo detecting portion for receiving the diffracted light diffracted by the diffraction means to output electrical signals in accordance with the amount of the diffracted light; wherein

the diffraction grating body receives the light beam with wavelength  $\lambda 2$  and transmits a main beam and generates sub-beams that are  $\pm$  first order diffracted light, and

the photo detecting portion comprises a photo detecting portion PD0 for receiving

a + first order diffracted light from the diffraction means, and a distance d1 between the

center of the photo detecting portion PD0 and the light emitting spot of the first

Serial No.: 10/010,721

Examiner: A. Psitos

TITLE: RELIEF DIFFRACTION GRATING BODY, AND OPTICAL PICK-UP AND OPTICAL INFORMATION APPARATUS

**USING THE SAME** 

semiconductor laser light source and a distance d2 between the center of the photo

detecting portion PD0 and the light emitting spot of the second semiconductor laser light source substantially satisfy the following relationship:

 $\lambda 1/\lambda 2=d1/d2$ .

17. (canceled)

- 18. (previously presented) The optical pick-up according to claim 16, wherein the diffraction grating body, the semiconductor laser and the photodetector are integrated into one package.
- 19. (currently amended) An optical information apparatus, comprising: an optical pick-up, comprising:

a diffraction grating body, comprising a base material, and a relief diffraction grating formed on the base material, wherein the diffraction grating body is formed of a single base material, and the refractive index nl of the single base material is 1.9 or more, the diffraction grating is formed of a concave portion and a convex portion having rectangular shaped cross sections, and the level difference h between the concave portion and the convex portion satisfies the following relationship:

 $h=\lambda 1/(n1-1)$ 

and the difference in an optical path between the concave portion and the convex portion is set to correspond to one wavelength with respect to the wavelength \( \lambda \right), and

a material of the single base material is at least one material selected from the group consisting of Ta<sub>2</sub>O<sub>5</sub>, <u>TiO<sub>2</sub></u>, ZrO<sub>2</sub>, Nb<sub>2</sub>O<sub>3</sub>, ZnS, LiNbO<sub>3</sub> and LiTaO<sub>3</sub>;

a first semiconductor laser light source for emitting a light beam with wavelength λ1;

Serial No.: 10/010,721

Examiner: A, Psilos Title: RELIEF DIFFRACTION GRATING BODY, AND OPTICAL PICK-UP AND OPTICAL INFORMATION APPARATUS

a second semiconductor laser light source for emitting a light beam with

wavelength  $\lambda 2$ ;

an optical system having an optical disk, the optical system for receiving the light beam with wavelength  $\lambda 1$  and the light beam with wavelength  $\lambda 2$  and converging the light beams onto a microspot on the optical disk;

a diffraction means provided as a separate element from the diffraction grating body, the diffraction means being arranged for diffracting a light beam reflected from the optical disk;

a photodetector having a photo detecting portion for receiving the diffracted light diffracted by the diffraction means to output electrical signals in accordance with the amount of the diffracted light; wherein

the diffraction grating body receives the light beam with wavelength  $\lambda 2$  and transmits a main beam and generates sub-beams that are ± first order diffracted light, and

the photo detecting portion comprises a photo detecting portion PDO for receiving a + first order diffracted light from the diffraction means, and a distance d1 between the center of the photo detecting portion PD0 and the light emitting spot of the first semiconductor laser light source and a distance d2 between the center of the photo detecting portion PD0 and the light emitting spot of the second semiconductor laser light source substantially satisfy the following relationship:

## $\lambda 1/\lambda 2=d1/d2$ ;

- a focusing control means for focusing the light beams on the optical disk;
- a tracking control means for tracking the light beams on the optical disk; and

Serial No.: 10/010,721

Examinar: A. Psilos Title: RELIEF DIFFRACTION GRATING BODY, AND OPTICAL PICK-UP AND OPTICAL INFORMATION APPARATUS

USING THE SAME

an information signal detecting means for detecting the output electrical signals;

and further comprising:

a moving means for moving the optical pick-up; and

a rotating means for rotating the optical disk.